MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2015/2016

DCS5068-DATA STRUCTURE & ALGORITHMS

(DIT)

2 MARCH 2016
2.30PM - 4.30PM
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This booklet consists of **6 pages** with **5 questions** only excluding the cover.

2. Attempt **ALL** questions. All questions carry equal marks and the distribution of the marks for each question is given.

3. Please write all your answers in the answer booklet provided. All necessary working **MUST** be shown in the answer booklet.

QUESTION 1 [20 marks]

a) Write a full C++ program based on the sample output screen and requirements given below. (17 marks)

- Create a constant value called *N_students* using preprocessor definition. Set the constant value to 2.
- Create a structure called *students_R*. The data members are:
  - *name* : string
  - *semester* : int
  - *GPA* : double
- Define a function named *printResult(...)* to display the results as shown in the sample output screen given below .
  - Pass a structure variable, *ST* as parameter.
- In *main()* function,
  - Declare a structure array variable called *studs* which the size of the array is based on the constant value.
  - Using a *for* loop, prompt the user to enter *name*, *semester* and *GPA*.
  - Using a *for* loop, call function *printResult(...)* to display the *name, semester* and *GPA* entered by user.

Sample output screen:

```
Student Name: Ayash bin Mohamad
Semester: 1520
GPA: 3.54
Student Name:  Nafisah Zulaikha Hamid
Semester: 1520
GPA: 3.02

You have entered these info:
Ayash bin Mohamad        1520    3.54
Nafisah Zulaikha Hamid   1520    3.02
```

printResult(...)

Continued .....

b) Trace and write the output produced by the C++ program below. (3 marks)

```
#include <iostream>
#include <cmath>
using namespace std;
class ACircle
{
    float rad;
  public:
    void set_values (float);
    double area () {return (3.142* pow (rad, 2));}
};
void ACircle::set_values (float radius)
{
  rad=radius;
}
int main () {
  ACircle circleA, circleB;
  circleA.set_values (5.2);
  circleB.set_values (3.3);
  cout << "Area of circle: \n";
  cout << "Circle A: " << circleA.area() << endl;
  cout << "Circle B: " << circleB.area() << endl;
  return 0;
}
```

QUESTION 2 [20 marks]

a) Table below represents an array implementation of a linked list. (5 marks)

Index	Data	Link
0	80	
1	32	
2	14	
3	42	
4	53	
5	76	
6	5	
7	11	
8	29	
9	65	

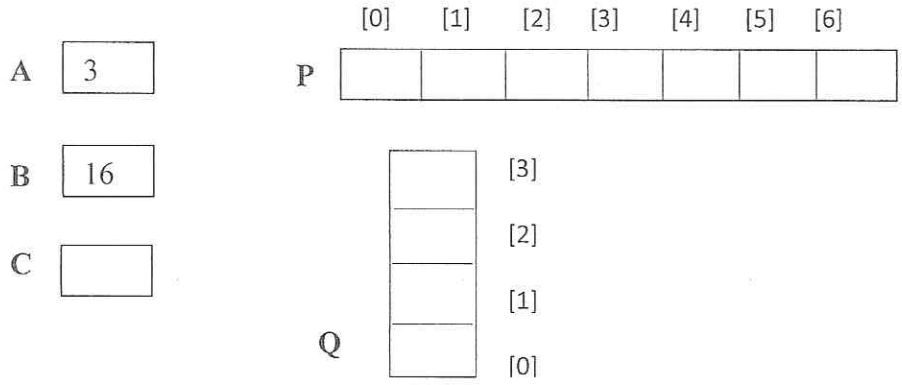
I. Taking **0** as the start of the list and **99** as a dummy representing the end of the list. Fill in the column link for all the elements in table to maintain the list in descending order. (2 marks)

Continued .....

II. Based on the answer above, draw an updated table after data **58** is added and data **42** is deleted from the list. (3 marks)

b) Suppose *P* is an empty queue of integers with seven elements and *Q* is an empty stack of integers with four elements. There are three integers *A*, *B* and *C*. Draw a sequence diagrams of *P, Q, A , B* and *C* after each of the following operations:

(15 marks)



I. P.append(A * 8);

II. Q.push(B % 10);

III. C= B * A;

IV. P.append(B + C);

V. for (i=2; i<5; i++)
{ A = A * i;
Q.push(A); }

VI. if(P.serve()<Q.pop())
{P.append (B / 3); }

VII. i = 2;
while (i>0)
{cout<<P.serve() + Q.pop()<<endl;
i--; }

Continued .....

QUESTION 3 [20 marks]

a) **Figure 1** illustrates the removal of the front item of a linked queue that contains more than one item. Three pointers declared which are *frontPtr*, *backPtr* and *tempPtr*. Write the codes based on the figure illustration below: (5 marks)

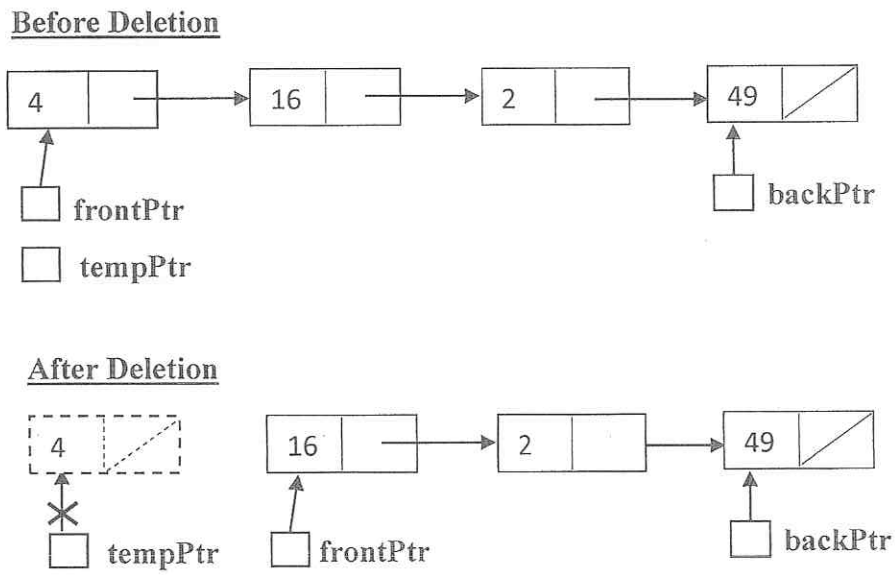


Figure 1

b) Explain how to determine the linked stack is empty. (1 mark)

c) Explain how to determine the linked queue is empty. (1 mark)

d) Explain why two pointers (*frontPtr* and *backPtr*) are used in the linked queue. (3 marks)

Continued .....

e) By using binary search, show step by step on how to find the target 59 in the array given. The following are the variables declared in the binary search algorithm.

(10 marks)

```
int table [8], target, first, last, mid;
```

Integer	10	21	28	35	42	49	57	60
Index	[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]

QUESTION 4 [20 marks]

a) Based on the following truncation, write the hashing function which return an index type integer for the key of 7 digits length. (6 marks)

i. Truncate last 2 digits of the key (e.g. key = 1234567, index = 12345).
ii. Truncate first 2 digits and last 3 digits of the key (e.g. key = 1234567, index = 34).

b) Sort the following data in descending order by using Insertion Sort. Write down the sequence of data and underline the sorted part after each iteration of sorting.

(7 marks)

P O S I T I V E

c) Explain how Quicksort works. (7 marks)

QUESTION 5 [20 marks]

a) If the values of A,B, C, and D are 10, 3, 4, and 5, respectively, compute the values of the following postfix expressions:

i) ABD + *C- (2 marks)
ii) AB-CD*B/+ (2 marks)

Continued .....

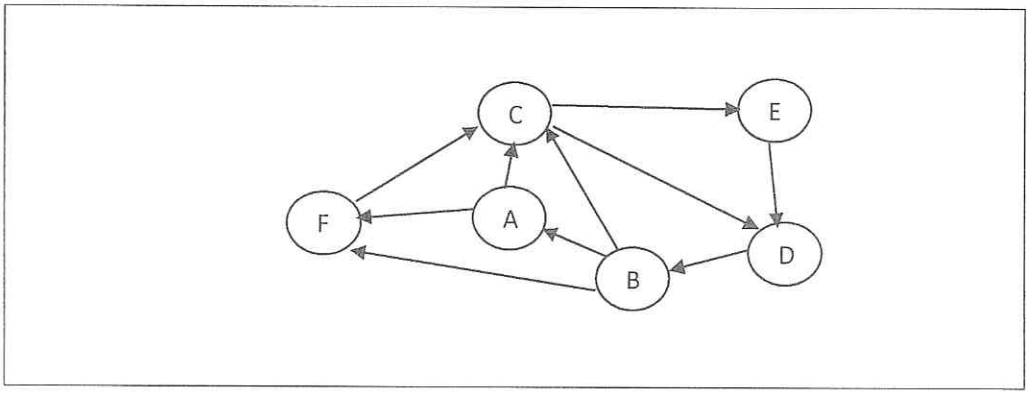
b) Complete the Preorder traversal function given where node pointer, *n* is used to trace the node. The following is the structure of the node: (6 marks)

```
struct node
{
    int data;
    node *left;   // A reference to the node's left child
    node *right; // A reference to the node's right child
};
```

```
void preOrder (------ i ------)
{
    if (------- ii -------)
    {
        -------------iii---------------
        -------------iv----------------
        -------------v ----------------
    }
}
```

c) Briefly describe depth-first traversal. (3 marks)

d) Represent the following graph using adjacency matrix and adjacency list. (7 marks)



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